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**Mulhern**

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(54) **WATERCRAFT LANDING CRADLE**

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(51) **Int. Cl.**[7] ..... **B63B 35/40**
(52) **U.S. Cl.** ..... **114/259**; 114/365
(58) **Field of Search** ..... 114/44, 45, 258–262, 114/343, 344, 364, 365, 366, 368; 405/1–7; 280/414.1; 414/137.7

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 1,410,243 | A * | 3/1922 | Brown et al. | 405/3 |
| 2,151,394 | A * | 3/1939 | Rogers | 405/3 |
| 2,325,994 | A * | 8/1943 | Zoll | 405/3 |
| 2,390,300 | A * | 12/1945 | Harris | 114/45 |
| 3,437,066 | A * | 4/1969 | Schwendtner | 114/260 |
| 3,539,065 | A * | 11/1970 | Brownell | 414/458 |
| 3,721,096 | A * | 3/1973 | Deckert et al. | 405/7 |
| 4,227,828 | A * | 10/1980 | Ivanov et al. | 405/1 |
| 4,243,344 | A * | 1/1981 | Gardon | 405/2 |
| 4,915,577 | A * | 4/1990 | Fraser | 414/476 |
| 5,234,285 | A * | 8/1993 | Cameron | 405/2 |
| 5,485,798 | A * | 1/1996 | Samoian et al. | 114/44 |
| 5,544,606 | A * | 8/1996 | Schmidt, Jr. | 114/48 |
| 5,613,462 | A * | 3/1997 | Schwartz | 114/362 |
| 6,047,659 | A * | 4/2000 | Schmidt, Jr. | 114/369 |
| 6,055,924 | A * | 5/2000 | Marshall et al. | 114/242 |
| RE37,061 | E * | 2/2001 | Stokoe et al. | 405/1 |
| 6,502,525 | B2 * | 1/2003 | Burke | 114/259 |
| 6,591,770 | B1 * | 7/2003 | Blackmore | 114/48 |
| 6,782,842 | B1 * | 8/2004 | Alvord | 114/369 |
| 6,786,170 | B2 * | 9/2004 | Trowbridge | 114/259 |

FOREIGN PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| DE | 4109578 | A1 * | 9/1992 | B63C 3/06 |
| EP | 196433 | A1 * | 10/1986 | B63C 5/04 |
| FR | 2620405 | A1 * | 3/1989 | B62D 63/08 |
| JP | 58211992 | A * | 12/1983 | B63C 5/04 |
| JP | 58211993 | A * | 12/1983 | B63C 5/04 |
| JP | 60056696 | A * | 4/1985 | B63C 13/00 |
| JP | 63137096 | A * | 6/1988 | B63C 1/02 |
| JP | 01078999 | A * | 3/1989 | B63C 1/02 |
| JP | 01085896 | A * | 3/1989 | B63C 1/02 |
| JP | 03235794 | A * | 10/1991 | B63C 1/02 |
| JP | 03253490 | A * | 11/1991 | B63C 15/00 |

* cited by examiner

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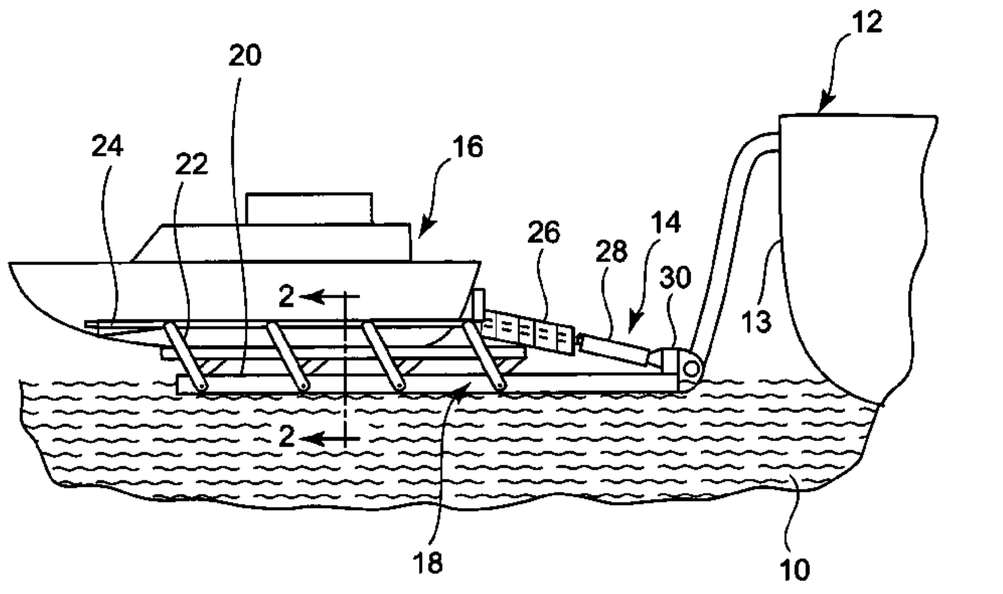
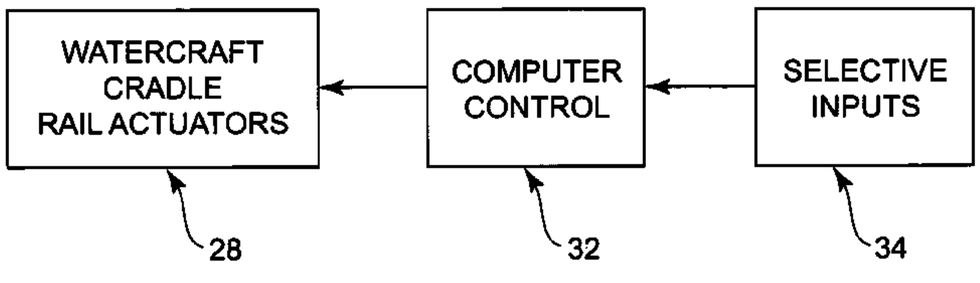
(57) **ABSTRACT**

A parallelgram arrangement of linkages interconnect a stern ramp frame with a plurality of parallel rails vertically adjusted to positions above the ramp frame by actuators for reception and maintenance of a watercraft thereon with minimized vibration, further reduced by shock-absorbing springs positioned in engagement with the rails and the rail actuators. Rail positioning adjustment by the actuators is effected under computer control to match different hull shapes of the watercraft that are curved or v-shaped and therefore non-flat.

**2 Claims, 3 Drawing Sheets**



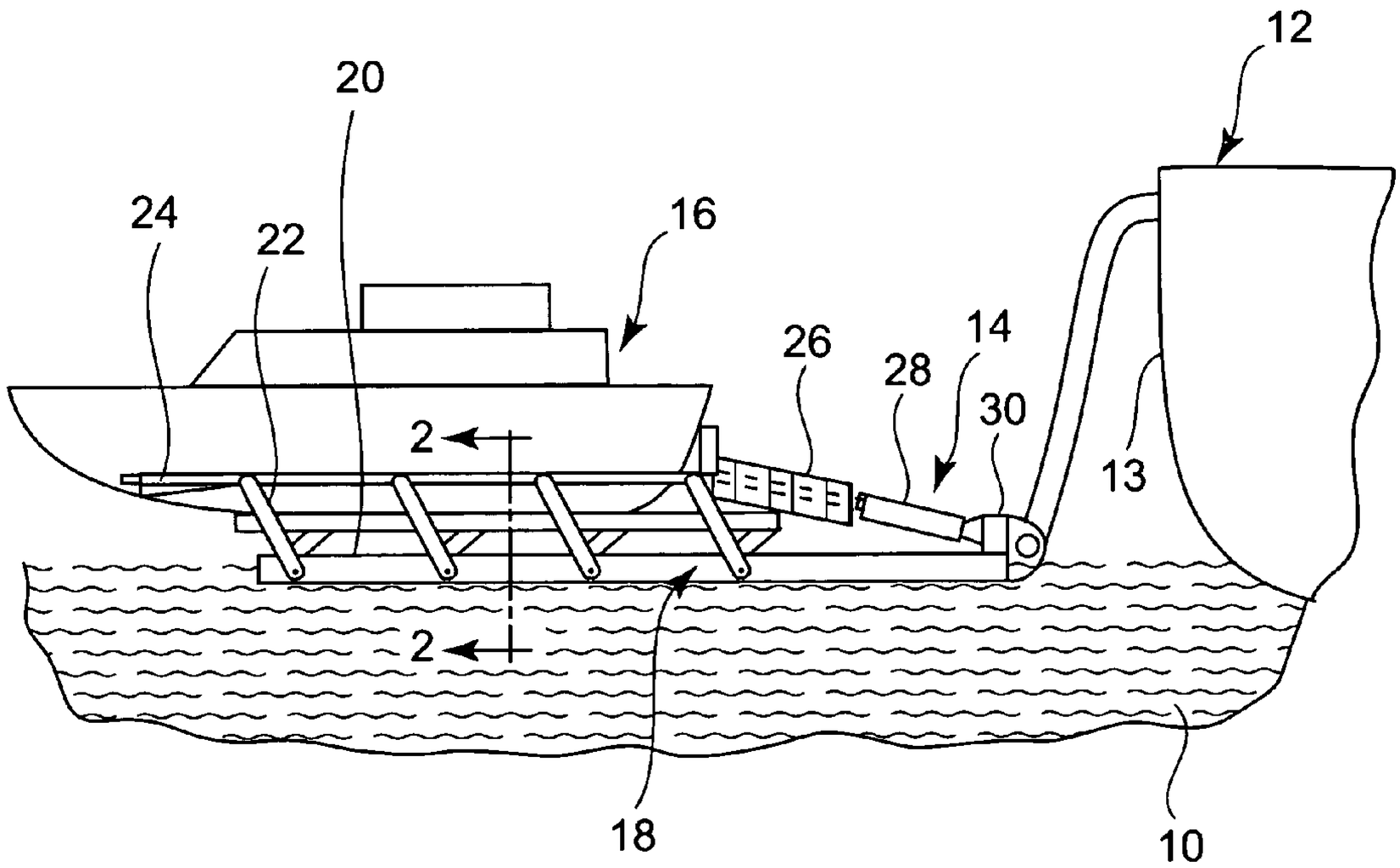



FIG. 1

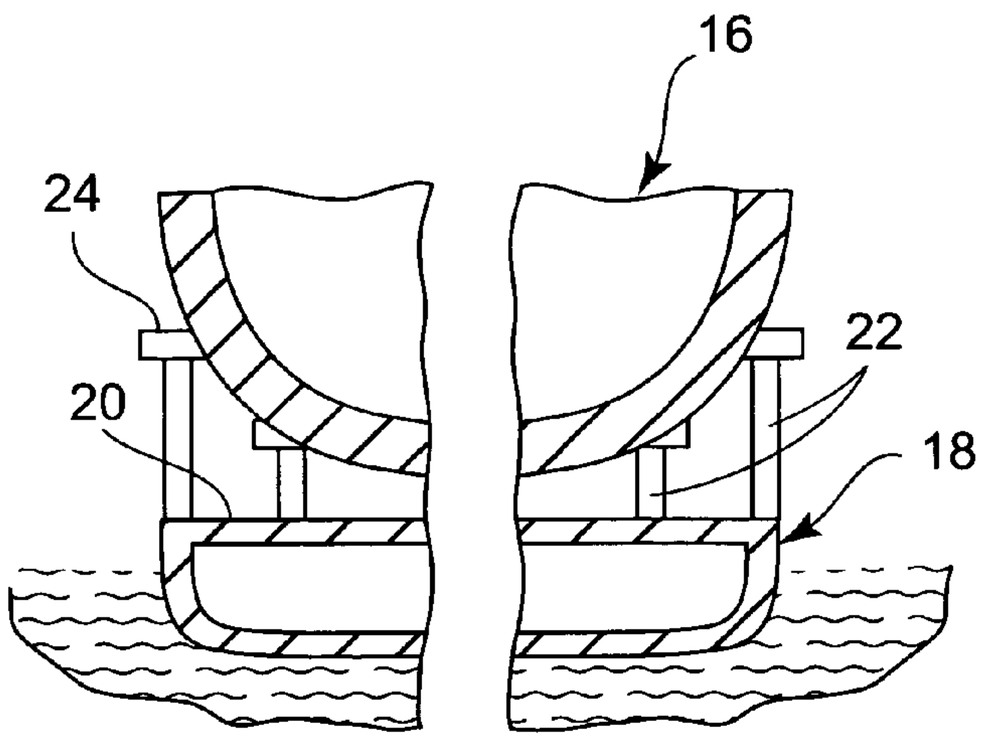



FIG. 2

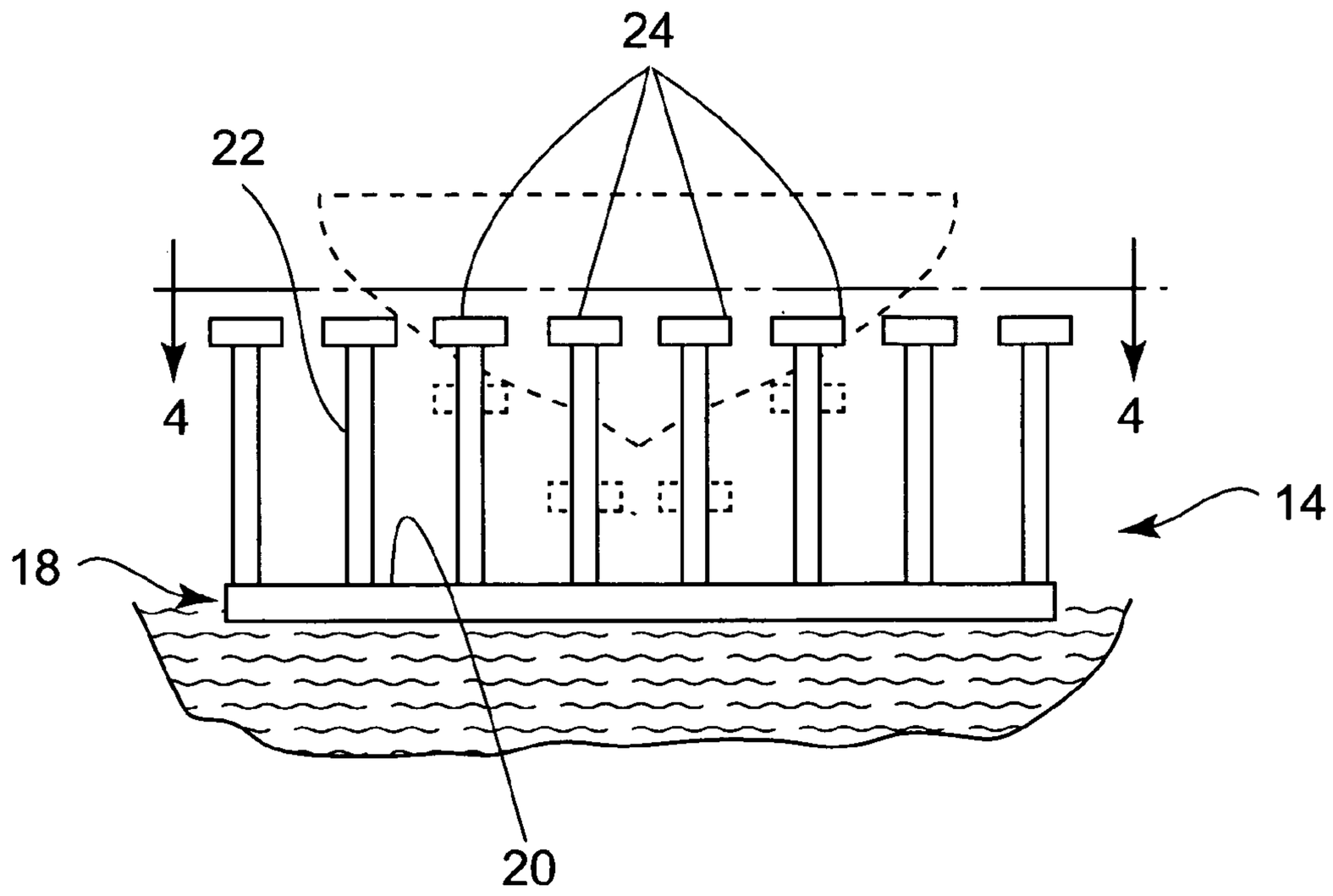



FIG. 3

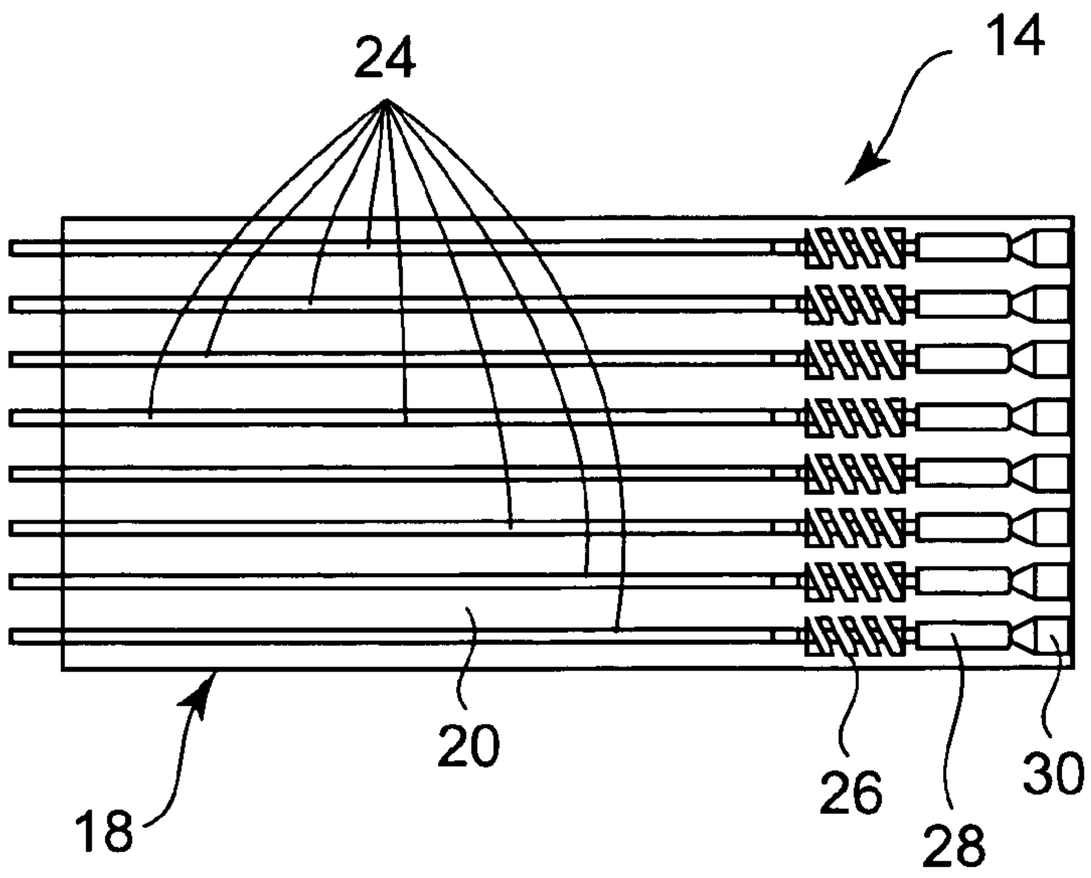



FIG. 4

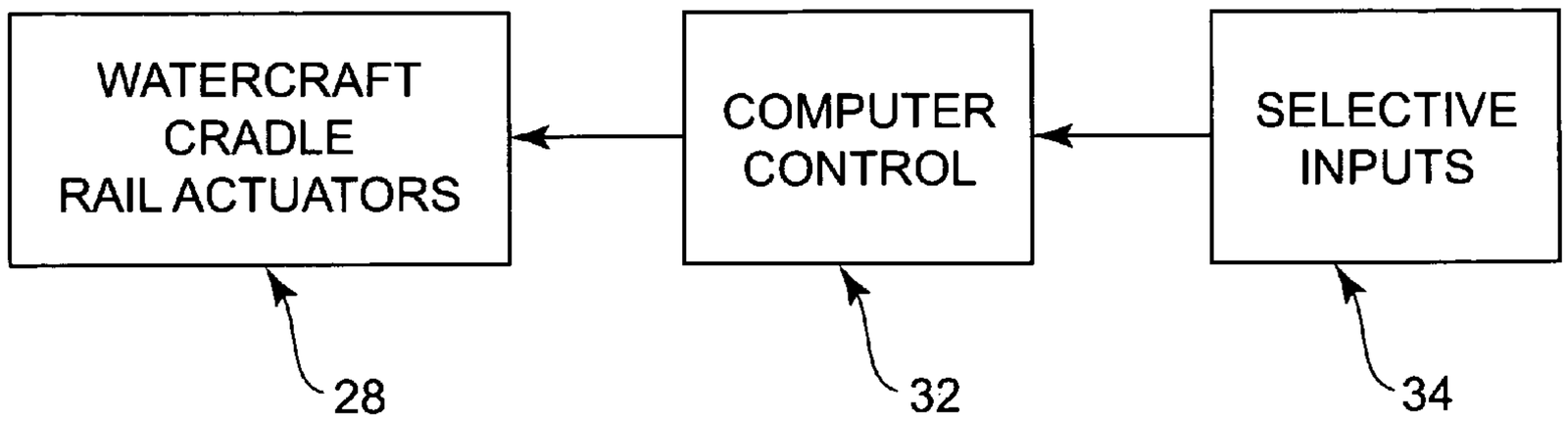

WATERCRAFT CRADLE RAIL ACTUATORS
COMPUTER CONTROL
SELECTIVE INPUTS
28
32
34

FIG. 5

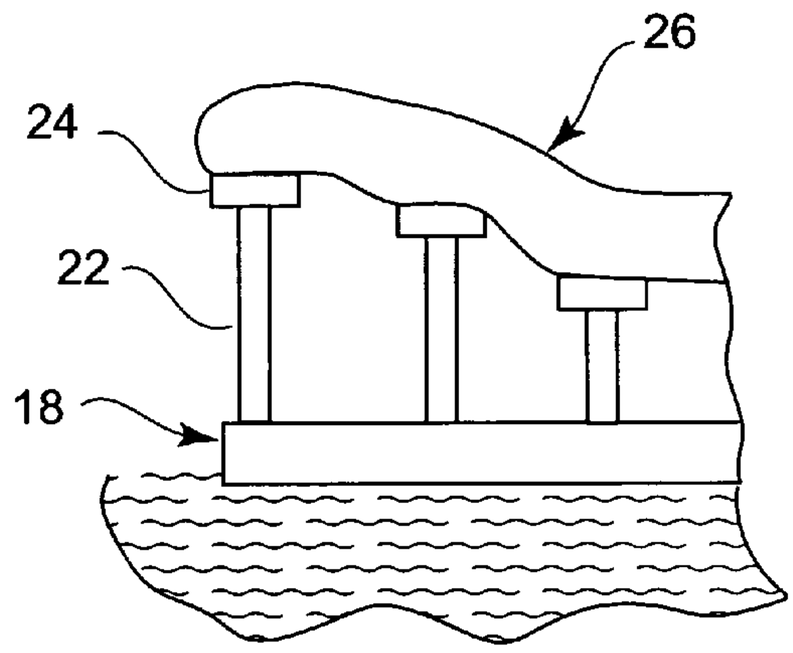

26
24
22
18

FIG. 6

# WATERCRAFT LANDING CRADLE

## STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefore.

The present invention relates to landing reception of watercraft on the stern ramp of sea vessels.

## BACKGROUND OF THE INVENTION

Watercraft are currently retrieved from a body of seawater onto a retrieval ship, involving use of a ramp projected from the stern of the ship onto which the watercraft is landed. Such ramp landing of watercraft often effects impact damage thereof because of hydrodynamic turbulence and ship motion, imposing displacement of the watercraft on the ramp. It is therefore an important object of the present invention to avoid the foregoing watercraft damage imposing problems during retrieval of watercraft onto ships.

## SUMMARY OF THE INVENTION

Pursuant to the present invention a rectangular ramp frame attached to the stern of a ship is provided with a plurality of parallel spaced horizontally elongated rails onto which a watercraft is landed and retained during retrieval onto the ship. Such rails are maintained in horizontal positions vertically spaced above the ramp frame by adjusted amounts in a parallelgram arrangement of linkages so that the vertical positions of the rails may be selectively varied to accommodate watercraft with different hull shape cross-sections. Such rail adjustment is effected through actuators pivotally interconnecting the rails with one end of the frame, under selective computer control. Watercraft are accordingly received on rails adjusted to match their hull shape for retention on the ramp frame with vibration due to sea condition reduced. Further vibration reduction is effected, by shock-absorbing springs in engagement with the rails at the ends thereof to which the actuators are connected.

## BRIEF DESCRIPTION OF DRAWING

A more complete appreciation of the invention and many of its attendant advantages will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIG. **1** is a side elevation view of a watercraft landed onto a floating ramp cradle attached to the stern of a retrieval ship;

FIG. **2** is a partial section view taken substantially through a plane indicated by section line **2—2** in FIG. **1**;

FIG. **3** is a front elevation view of the floating ramp cradle with all landing rails horizontally aligned in their topmost positions;

FIG. **4** is a top elevation view of the ramp cradle as seen from section line **4—4** is in FIG. **3**;

FIG. **5** is a diagram of the rail adjustment system associated with the ramp cradle shown in FIGS. **1–4**; and

FIG. **6** is a partial front elevation view corresponding to that of FIG. **3**, showing the rails in adjusted positions with an inflated shock-absorbing cover thereon.



## DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the drawing in detail, FIG. **1** illustrates a body of seawater **10** underlying a ship **12** floating thereon having a stern end **13** to which a cradle ramp **14** is attached for landing or reception thereon of a watercraft **16**, such as a small boat or unmanned sea vehicle. The watercraft **16** received on the cradle ramp **14** from a location on the surface of the seawater **10** or from a location submerged therein may be transferred from the ramp cradle **14** onto the stern of the ship **12** as generally known in the art. However pursuant to the present invention, the cradle ramp **14** is selectively adjusted in configuration prior to reception of the watercraft **16** thereon to avoid damaging thereof during reception and retrieval onto the ship **12** from its seawater location.

As shown in FIGS. **1–4**, the cradle ramp **14** includes a bottom floating frame **18** having a top rectangular support surface **20**, with a plurality of parallelgram linkages **22** pivotally interconnected between rails **24** and at spaced locations on the frame **18** for horizontally positioning of a plurality (8 to 10) of the rails **24**, disposed in parallel spaced relation to each other as shown in FIGS. **3** and **4**. One end of each of the rails **24** projects beyond the top frame surface **20**, while the other rail end is connected to an actuator **28** pivotally connected to the end of the frame **18** by a pivot anchor **30**. Such actuators **28** extend through shock-absorbing coil springs **26** in abutment with the ends of the rails **24** opposite the other ends projecting beyond the frame **18**. Thus, each of the rails **24** is displaced horizontally by its actuator **28** so as to effect pivotal displacement of the linkages **22** extending therefrom to the bottom frame **18**, so as to effect vertical displacement of the rails **24** by different amounts between lower and higher horizontal positions as shown in FIG. **2**, corresponding to the hull shape of the watercraft **16** received thereon.

Accordingly, vertical positioning of the rails **24** is selectively varied from their horizontally aligned top positions as shown in FIG. **3** in order to conform to the hull shape of the watercraft **16**, which is generally cylindrical as shown in FIG. **2**. Other differently shaped watercraft hulls, such as V-shaped hulls, may also be accommodated by positional adjustment of the rails **24** through the rail actuators **28** under computer control **32** as diagrammed in FIG. **5**. In response to selective inputs **34**, differently shaped watercraft hulls may thereby be landed on the cradle ramp **14** with minimized impact after controlled adjustment of the rails **24**, while impact induced vibrations because of sea conditions are thereafter reduced by the shock-absorbing springs **26**.

According to other embodiments of the present invention, an inflatable cover **36** may be placed onto the adjusted rails **24** as shown in FIG. **6**, before landing of a watercraft thereon.

Obviously, other modifications and variations of the present invention may be possible in light of the foregoing teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

**1**. A cradle on which a water craft is landed, comprising: a seawater floating frame; a plurality of elongated rails on which the landed watercraft is positioned above the frame; linkage means operatively interconnecting the frame with the rails for movement thereof to adjusted positions differently spaced from the frame; actuator means connected to the rails for selectively imparting said movement thereto to

said adjusted positions corresponding to cross-sectional hull shape of the watercraft prior to landing of the watercraft on the cradle; and spring means engaged with the rails and the actuator means for shock-absorption of vibrations imparted to the watercraft during retention on the rails after being landed thereon.

**2**. In combination with a retrieval ship having a stern, a cradle ramp connected to the stern on which a watercraft is landed, comprising: a frame; a plurality of elongated rails; linkage means operatively interconnecting the frame with



the rails for movement thereof between positions differently spaced from the frame; actuator means connected to the rails for selectively imparting said movement thereto to said positions adjusted to correspond to cross-sectional hull shape of the watercraft; and spring means engaged with the rails and the actuator means for shock-absorption of vibrations imparted to the watercraft during retention on the rails after being landed thereon.

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